

Executive Summary

# **What Will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure**

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# **The Importance of Making Economically Informed Decisions**

## **Introduction**

Sea level rise (SLR) poses a serious threat to coastal communities. Global sea level has been rising over the past several decades and is expected to continue to rise in the decades to come. With coastal communities increasingly vulnerable to coastal hazards, community leaders need to consider future SLR in their decision-making.

The purpose of *What Will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure* is to help decision-makers in the local, state, or federal government make informed economic decisions about adapting to coastal flooding from SLR and high-water-level events such as storm surge or astronomical high tides. The detailed guide provides a step-by-step methodology that communities can pursue, describing a scenario-based approach to develop the full range of costs and benefits of various adaptation strategies. This framework is intended to help community leaders answer questions such as:

- How will SLR and storm surge affect my community?
- What is the cost of doing nothing?
- What can we do to adapt?
- How can I begin to determine the best adaptation strategy for my community?
- How much will it cost to keep my community safe?

Using this framework to make economically informed decisions can help achieve safer, more resilient, and fiscally sound communities. In the long run, the entire community benefits by investing in adaptation efforts: after a flood event, utilities will be restored quicker, stores and banks will be open earlier, children will return to school sooner, and employees will be back at work with minimal disruption. Up-front investments can help ensure a successful future. By accounting for the significant costs of a disaster and associated risks, leaders can make strategic choices about where, when, and how to make investments in adaptation responses to maximize benefits and minimize risk.

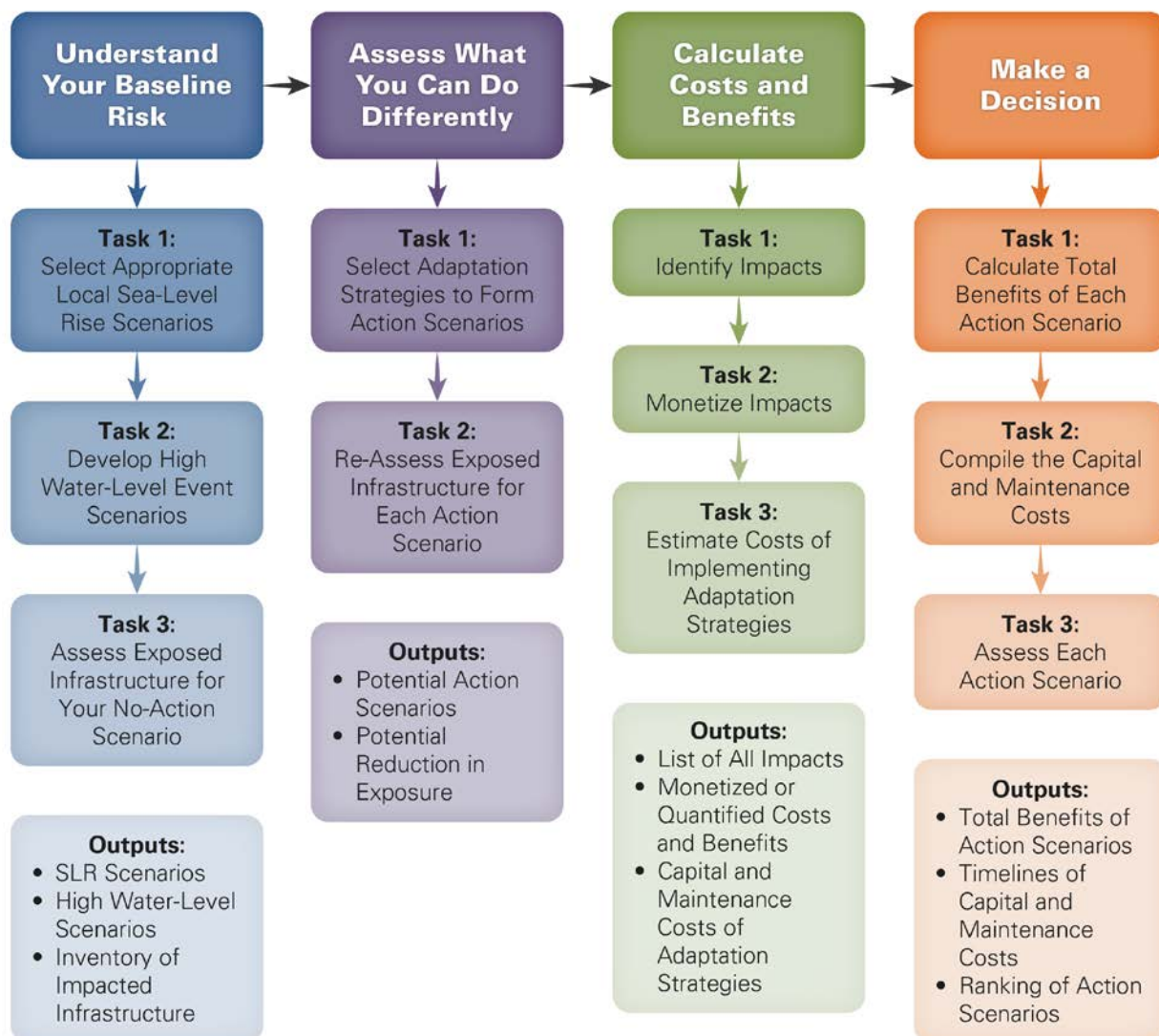
## **Role for Community Leaders**

This executive summary is intended to help community leaders gain a better understanding of the process and resources needed to employ the economic framework in *What Will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure*. The executive summary provides a general overview of the process and the expertise needed to complete the process.

This framework, illustrated in Figure 1, is highly adaptable and can help any community make decisions about investing in adaptation strategies. Communities can use it to assess the impact of inundation on their entire infrastructure, which is referred to as the holistic approach. Alternatively, if a community

wants to focus on select infrastructure, such as a hospital or wastewater treatment plant, the framework allows for this priority infrastructure approach.

**Figure 1: Framework for Making Informed Decisions**



Although the framework is accessible to a general audience, several steps require specialized expertise or training to implement. In order to successfully employ this framework, it is necessary to assemble a team that includes many types of experts.

### What Types of Experts Are Typically Needed?

- **GIS analysts** to help your team use spatial data.
- **Inundation modeling experts** to help predict flooding impacts.
- **Engineers** to help you estimate the capital and maintenance costs of resilient infrastructure.
- **Economists** to help you monetize the costs and benefits, determine a discount rate, and interpret your results.
- **Planners and Land-Use Attorneys** to select and assess the feasibility of implementing adaptation strategies.

Community leaders are also encouraged to use this framework to guide the gathering of relevant information when beginning the adaptation planning process. If you do not have the needed expertise in-house for some of the analyses, this framework can help you craft an effective solicitation for proposals to get the necessary consultant support.

## Understand Your Baseline Risk

The first stage in our framework is intended to help you understand what's at stake if your community does nothing to mitigate the effects of coastal hazards and rising sea levels. Costs, risks, and vulnerability influence every community's coastal hazard policies, but comparing the cost of inaction to the benefits of taking action is how a community can feel confident that it is making a fiscally and socially responsible decision when implementing an adaptation strategy. Using this process-based approach for defining risk and vulnerability will help arm your community to make decisions about what infrastructure really matters with respect to coastal hazards.

Future SLR will have a compounding effect on coastal flooding events and must be considered when determining baseline risk. Global SLR has been a consistent observable trend for decades and is expected to continue for the foreseeable

### Key Tasks:

- **Select appropriate SLR scenarios:** Use existing data to select appropriate local sea level scenarios.
- **Develop high-water-level event scenarios and integrate them with SLR projections:** Review historical data to select a range of high-water-level events such as storm surge or astronomical high tides, and integrate these data with SLR scenarios to select the water-level event heights that you would like to use as the basis for assessing damage from flooding.
- **Assess exposed infrastructure in a no-action scenario:** Integrate the selected SLR scenarios and high-water-level events to develop coastal flooding scenarios and identify at-risk infrastructure for each scenario.

future. If your community establishes its baseline risk without factoring in SLR, you could be significantly underestimating your vulnerability to coastal hazards in the future. Consider that because of SLR, today's occasional coastal floods will become regular events. In this stage, your team will develop high-water scenarios for major and minor storm events.

Your team will also develop:

- SLR scenarios to select appropriate water-level height increases to use as the basis for assessing damage from flooding.
- An inventory of impacted infrastructure, built structures, and other priority assets to assess your community's exposure to coastal flooding.

Local decision-makers cannot completely observe a community's vulnerability without performing formal assessments, either as stand-alone projects or as part of this guide's overall framework. NOAA and other organizations have developed guidance and tools specific to vulnerability assessments that help communities complete this step.

## Assess What You Can Do Differently

Once your community understands the severity of the risk it currently faces from coastal hazards, the next stage is for your team to explore what actions your community can take to mitigate these risks. These action scenarios can be assessed to determine how they would alter the severity of impacts on your community for the high-water-level event scenarios developed in the previous stage.

In this stage, your team will develop action scenarios specific to your community, each employing one or more flooding adaptation strategies. For each action scenario you develop, you will assess the change to the impacts on your community or priority infrastructure for each given water-level increase.

Your community should consider several different action scenarios with a range of adaptation strategies and resource intensities in order to identify the best a course of action for your community. Some communities may find that a combination of less expensive adaptation strategies can provide the most cost effective approach, while others will determine that a single more expensive capital investment is clearly the way to go.

### Key Tasks:

- **Select flooding adaptation strategies to form action scenarios:** Develop one or more action scenarios that each includes one or more flooding adaptation strategies.
- **Re-assess your exposed infrastructure for your action scenarios:** For each action scenario, identify your at-risk infrastructure and land area.

## Calculate Costs and Benefits

The next stage will help your team monetize—or assign a dollar value for the purpose of financial analysis—the impacts of coastal flooding on your community. However, before your team can monetize the impacts, they will need to identify and fully understand the severity of potential impacts. Impacts are typically categorized as primary such as direct infrastructure damage, secondary such as business interruption, and environmental such as beach damage. Communities are complex systems and any impact, natural or human, can create a ripple of desirable or undesirable consequences.

Traditional analyses of the impacts resulting from coastal flooding focus on primary impacts—usually the costs associated with structural damage and loss of life—but sometimes fail to identify secondary and environmental impacts. The failure to account for impacts beyond primary ones can underestimate the true cost or benefit and lead to poor decision-making.

In this stage, your team will monetize impacts resulting from taking action by implementing adaptation strategies. The monetized values of the impacts of implementing adaptation strategies can be positive or negative, adding to or subtracting from the net benefit of each action. The detailed guide describes some comprehensive tools, databases, methodologies, and general approaches for monetizing the impacts. The resources necessary to monetize every impact, in many cases, can be overwhelming; thus, it will be very important for your team to focus its resources on the most substantial impacts and to remember to consider any non-monetized impacts qualitatively as you assess each action scenario.

Your team will also develop:

- Lists of all potential impacts of coastal flooding on your community and the impacts from implementing resilient infrastructure options.
- Estimates of all capital and maintenance costs of implementing the adaptation strategies.

### Key Tasks:

- **Identify impacts:** Recognize and categorize the potential impacts of coastal inundation on your community and the impacts from implementing resilient infrastructure options.
- **Monetize costs and benefits:** Select tools, models, and other techniques to monetize costs and benefits of the impacts based on available resources.
- **Estimate capital and maintenance costs of implementing resilient infrastructure:** Estimate the costs associated with implementing resilient infrastructure.

## Make a Decision

The final stage of this framework will help you decide whether it makes financial sense—the benefits outweigh your costs—to pursue an action scenario. If your team prepared multiple action scenarios, it is possible that more than one of them makes financial sense.

To make a truly informed decision, you will need to consider the qualitative impacts in each action scenario. In some cases, the monetized results speak loudly. In other cases, a decision based on the monetized impacts alone will be less conclusive and considering the qualitative impacts could lead you to the best decision for your community.

If you prepared multiple action scenarios, more than one of them might make financial sense; in that case, you will want to find the best option for your community based on the cost-benefit results, financial feasibility, and other relevant considerations.

Your team will also develop:

- Timelines of capital and maintenance costs.
- Rankings of the action scenarios.

Even after your analysis produces its results, various considerations and external barriers can sometimes make even informed decisions quite difficult. One common consideration is how much the benefit outweighs the cost for each action scenario—knowing whether you receive \$10, \$4, or \$1.10 in benefits for every \$1 spent on implementation is critical to your decision. You will also need to consider whether it is feasible to raise the necessary funding to implement a chosen adaptation strategy. Required funding typically includes the initial capital as well as funding for maintenance through the years, which is too often overlooked.

It's also helpful to identify any obstacles beyond the economic costs and benefits such as social feasibility, community culture, and administrative and legal aspects, which might hinder or prevent implementation. Finally, you might also want your team to discuss the question of who pays for implementing adaptation projects and who benefits from them when determining the best solution for your community.

### Key Tasks:

- **Calculate total benefits of each action scenario:** Calculate the total benefits of each action scenario for each high-water-level event using impact costs and other costs and benefits monetized earlier.
- **Calculate the total net present value of capital and maintenance costs for each action scenario**
- **Assess each action scenario:** Determine which action scenarios, if any, have total benefits that exceed total costs. Rank those that do based on the cost-benefit results, financial feasibility, and any other factors you want to consider.